

WHAT IS CLAIMED IS

1. A machine for making filter bags (1) containing an infusion product, the machine comprising the following, arranged in succession:
 - a unit (53) for preparing and feeding the materials used to make the filter bags (1), in which: a web (17) of filter paper bearing a layer of heat-activated glue, a continuous thread (31) and a row of tags (6) are fed in coordinated fashion and associated with each other, the filter paper web (17) and the thread (31) moving continuously through the feed unit (53), while the tags (6) and the thread (31) are associated with each other in rhythmical sequence at the ends of thread portions (7) which: lie lengthwise relative to the filter paper web (17); have a predetermined length; and are delimited at their ends by first loops (10) made in the thread (31) itself;
 - a metering assembly (54) which places charges (19) of the infusion product on the filter paper web (17);
 - 15 a forming unit (55), a dividing unit (56) and a cutting unit (57), in the forming unit (55), the web (17) of filter paper being folded onto itself in such a way as to form a tube (34), inside which the metering assembly (56) places charges (19) of the infusion product, the tube (34) then being gradually closed by sealing it along its longitudinal edges (18); in the dividing unit (56), pairs of sealed transversal joins (4, 5) being made in the tube (34) upstream and downstream of each tag (6), these transversal sealed joins (4, 5) dividing the tube (34) into a succession of substantially

flattened containment chambers (2) containing corresponding charges (19) of the infusion product; in the cutting unit (57), the tube (34) being cut into successive lengths, lying flat and lengthwise and each constituting the containment chamber (2) of a filter bag (1).

2. The machine according to claim 1, comprising, downstream of the cutting unit (57), a turning unit (58) designed to make the containment chambers (2) of the filter bags (1), received in a flattened condition, rotate about a longitudinal axis (50) to adopt a final position in 5 which the containment chambers (2) have turned through a predetermined angle; this final position being maintained through all the remaining steps in the process which the filter bags (1) undergo in the machine (100).

3. The machine according to claim 2, wherein the filter bag (1), in the final position, has been turned about its longitudinal axis (50) through an angle of 90° relative to the position it had prior to being turned.

4. The machine according to claim 1, 2 or 3, wherein the filter bag (1) after adopting the final, unchanging position, is made to interact with at least one of the following units: a unit (173) for sealing the pouches (3) of the filter bag (1) containment chambers (2); a unit (59) for trimming 5 the corners (23) of the top ends (15) of the containment chambers (2); a unit (60) for wrapping the filter bags (1) in envelopes; and a cartoning unit (61) for placing the filter bags (1) in a packaging container (52).

5. The machine according to claim 4, wherein the trimming unit (59), the unit (60) for forming the envelope (51), and the cartoning unit (61) are located downstream of the tube (34) cutting unit (57) one after the other along a feed path (62) of the filter bags (1).

6. The machine according to any of the foregoing claims from 1 to 5, wherein the cutting unit (57) creates lengths of tube (34) each constituting the chamber (2) containing the infusion product and consisting of two pouches (3), each containing a charge of the infusion product, and 5 being connected to each other along a central sealed join (5), the machine comprising a folding unit (63) where the pouches (3), initially stretched out flat one after the other, are folded about the sealed join (5) between them in such a way as to adopt a mutually superposed position.

7. The machine according to claim 1, wherein the unit (53) for preparing and feeding the filter bag materials comprises the following arranged in succession around the edge of a power-driven revolving wheel (70):

5 first means (71) for forming filter bag (1) pick-up tags (6) from a web (39) of suitable material and arranging them in suitable order around the edge of the revolving wheel (70);

10 second means (72) for feeding a continuous thread (31) and forming in it first loops (10) at regular intervals from each other at positions corresponding to the pick-up tags (6) carried by the revolving wheel (70);

third means (73) acting on the tags (6) for delimiting separate faces (9a, 9b) on each tag (6) and folding these faces (9a, 9b) onto each other in such a way that the first loops (10) of thread are held between the faces (9a, 9b) of the tags (6);

5 fourth means (74) for joining the faces (9a, 9b) of each tag (6) to each other;

10 fifth means (75) for associating a web (17) of filter paper, which has on it a layer of glue that can be thermally activated, with the edge of the revolving wheel (70) and positioning it over the continuous thread (31) and over the tags (6) connected to it;

15 sixth means (76) associated with the revolving wheel (70) for pushing a portion (7) of the continuous thread stretched on the edge of the wheel (70) through the web (17) of filter paper in such a way as to form a second loop (11) extending outwards from the wheel (70) and protruding from a face of the filter paper web (17) opposite the face adjoining the tags (6).

8. The machine according to claim 7, comprising seventh means (77) for attaching the second thread loops (11) and the tags (6) to the filter paper web (17).

9. The machine according to claim 7, wherein the first means (71) for forming the tags (6) comprise: a rotary knife (80) mounted near the edge of the revolving wheel (70), designed to cut a web (39) of suitable material into lengths, each corresponding to an individual tag (6); retaining 5 means (78) for holding the tags (6) to the edge of the wheel (70); and pegs

(79) projecting outwards from the edge of the wheel (70), the pegs (79) being located on each side of the retaining means (78) and acting in combination with the latter in such a way as to place the tags (6) at predetermined positions around the edge of the wheel (70).

10. The machine according to claim 7, wherein the second means (72) for feeding the continuous thread (31) comprise a tubular spindle (81), equipped with an arm (82) projecting towards the wheel (70) and transversal to the axis of rotation (83) of the spindle (81), the spindle (81) supplying the arm (82) with a continuous thread (31) and rotating the arm (82) in synchrony with the rotation of the wheel (70) in such a way as to wind at least one first loop (10) of thread around the pegs (79) protruding from the wheel edge, each first thread loop (10) being placed on a tag (6) located between the pegs (79).

11. The machine according to claim 7, where the tag (6) has two adjacent faces (9a, 9b) delimited by a central fold line (21), wherein the third means (73) for delimiting the separate faces (9a, 9b) of the tags (6) comprise a fixed folding element (84) associated with the edge of the 5 revolving wheel (70) and designed to intercept a lateral edge of the tag (6) as the latter moves past as one with the revolving wheel (70), the fixed folding element (84) gradually folding one face (9b) of the tag (6) onto the other face (9a) in such a way as to hold the first thread loops (10) between the faces (9a, 9b).

12. The machine according to claim 7, where the web (39) of tag (6) material has a layer of glue which can be thermally activated, wherein the fourth means (74) for joining the faces (9a, 9b) of each tag (6) to each other comprise a first heating device (85) associated with the outer edge of 5 the revolving wheel (70) and located downstream of the third means (73) in the direction of rotation of the revolving wheel (70).

13. The machine according to any of the foregoing claims, wherein the fifth means (75) comprise a flexible element (86) trained around a pair of pulleys (87, 88), at least one of which is power driven, the flexible element (86) lying against a peripheral portion of the wheel (70) 5 and pressing the filter paper web (17) against the wheel (70) causing it to move forward together with the wheel (70).

14. The machine according to claim 13, wherein the flexible element (86) comprises a chain having links (89) and pins (90) which flexibly connect the links (89).

15. The machine according to claim 7, wherein the sixth means (76) comprise a needle (91) housed inside the wheel (70) and driven by actuating elements in synchrony with it, the needle (91) being designed: to rhythmically protrude from the edge of the wheel (70); to strike the

continuous thread (31); and to push a portion (7) of the thread through the filter paper web (17) to the opposite face of the filter paper web (17) adjacent to the flexible element (86).

16. The machine according to claims 14 and 15, wherein the needle (91) and the flexible element (86) are synchronized with each other in such a way that the needle (91) is driven through the chain at the links (89).

17. The machine according to claim 8, wherein the seventh means (77) for joining the filter paper web (17), the second loops (11) of thread (7) and the tags (6) comprise a second heating device (92), which is associated with the edge of the revolving wheel (70) and which 5 thermally reactivates the layer of glue on the filter paper web (17) at an area around the second loop (11) and a layer of glue on an edge (38) of the underlying tag (6) facing the opposite face of the filter paper web (17), the second heating device (92) being designed to join one side of the filter paper web (17) to the second loop (11) and the other side of it to the tag 10 (6).

18. The machine according to claim 15, comprising means for making incisions or slits (22), at regular intervals in the filter paper web (17), in order to make it easier for the needle (91) to move through the filter paper web (17) to form the second loop (11).

19. The machine according to claim 1, wherein the forming unit (55) comprises means (94) for sealing the longitudinal edges (18) of the tube (34) working from inside the tube to reactivate the layer of glue on the filter paper web (17).

20. The machine according to claim 19, wherein the sealing means comprise a sealing element (94) equipped with nozzles (96) that emit a gaseous fluid at a suitable temperature, the sealing element (94) being located in the forming unit (55) in such a way as to be 5 accommodated inside the filter paper tube (34) being formed from the filter paper web (17) as the latter is fed through the forming unit (55), and, as the filter paper web (17) moves, the emitter nozzles (96) directing the gaseous fluid at the faces (97) of the longitudinal edges (18) of the tube (34) facing the inside of the tube (34) itself.

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21. The machine according to claim 19 or 20, wherein the sealing element (94) has the shape of an elongated, tapering solid and is positioned in such a way that its wide end faces the direction opposite the direction in which the web (17) of filter paper is being fed through the 5 forming unit (55), the sealing element (94) having oblique side walls (98) bearing the nozzles (96) in such a way that the latter face the inside of the tube (34) in order to reactivate the glue on the faces (97).

22. The machine according to claim 20 or 21, wherein the nozzles are apertures (96) passing through the oblique side walls (98) and communicating with a conduit (99), which is supplied with the gaseous fluid.

23. The machine according to claims 2 and 6, comprising a first wheel (123) that rotates about a horizontal axis of rotation (124), the folding unit (63) and the turning unit (58) combining to form an operating unit (148) associated with the wheel (123).

24. The machine according to claim 23, wherein the folding unit (63) comprises a device (105) for clamping the infusion product containment chamber (2) and a system of grippers (106), pivotably mounted around horizontal axes (110), the clamping device being 5 designed to hold the lengths of tube (34) by the sealed join (5) connecting two contiguous pouches (3) of the containment chamber (2), the system of grippers (106) being designed to fold the pouches (3) of the containment chamber (2) onto each other so that they are mutually superposed.

25. The machine according to claim 24, wherein the clamping device (105), while it holds the filter bag (1), also makes a fold in the bottom sealed join (5) which connects the pouches (3).

26. The machine according to claim 25, wherein the clamping and folding device (105) comprises a pair of folding blades (107) and a

folding counterblade (108) on opposite sides of the filter bag (1) and pressing against each other in such a way as to make a fold in the bottom sealed join (5) between two pouches (3); pressers (109) being provided, one on each side of the folding counterblade (108), which elastically 5 oppose each other to allow the folding blades (107) to pass freely between them and the counterblade (108) when the folding blades (107) and the counterblade (108) move towards each other, and, instead, to securely hold the bottom fold in the filter bag (1) by pressing it against the counterblade (108) when the folding blades (107) move away from the 10 counterblade (108).

27. The machine according to claim 26, wherein the folding blades 107 and the counterblade (108) are mounted on a revolving wheel (151) and on the first gripper (106) mounting wheel (123), which are coupled in rolling relationship of relative primitive circles (152, 153) in such 5 a way that the folding blades (107) and the counterblade (108) mesh with each other.

28. The machine according to claim 25, wherein the pressers (109) are mounted in such a way that they can swing about respective horizontal axes (110).

29. The machine according to claim 23, wherein each gripper (106) includes a pair of levers (116) which are rotatably mounted on fixed pins (117), the levers (116) opening and closing in such a way as to make

the pouches (3) of the filter bag (1) rotate about the common sealed join (5) until they are mutually superposed.

30. The machine according to claim 29, wherein the levers (116) are mounted crosswise.

31. The machine according to claim 30, wherein the levers (116) have specially shaped ends (118) designed to interact with each other and to grip the filter bag (1) close to its top end (15) as soon as the pouches (3) of the filter bag (1) are folded onto each other.

32. The machine according to any of the foregoing claims from 29 to 31, wherein the folding unit (63) comprises a device (111) for actuating the levers (116) equipped with a rack (113) mounted on a slidable rod (112) and rotatable pinions (114) which mesh with the rack 5 (113) and which are attached to the levers (116), the sliding motion imparted on the rod (112) by an actuating element (115) in a first direction of rotation of the levers (116) causing the filter bag (1) to be folded in such a way as to superpose the pouches (3) of the containment chamber (2), and to be held by its top end (15), the sliding motion in the opposite 10 direction placing the levers (116) in a condition in which they are ready to receive a length of filter bag tube with the containment chamber (2) pouches (3) positioned in line.

33. The machine according to claim 32, wherein the actuating element (115) comprises a cam (155) associated with the slidable rod (112).

34. The machine according to claim 23, wherein the turning unit (58) comprises a head (149) that revolves about an axis (121) radial to the first gripper mounting wheel (123), means (120) for rotationally actuating the head (149) in synchrony with the rotation of the first wheel (123) 5 causing the folding unit (58) to rotate in such a way as to turn the filter bag (1) so that the plane which it finally lies in is transversal to the axis of rotation (124) of the first wheel (123).

35. The machine according to claim 34, wherein the means (120) for rotationally actuating the head (149) comprise linkages (122) driven by mechanical cams in synchrony with the rotation of the first gripper wheel (123).

36. The machine according to claim 23, wherein it comprises a unit (59), which is associated with the edge of the first wheel (123) and which is designed to trim the top end (15) of the filter bag (1).

37. The machine according to claim 23 or 36, comprising a second gripper wheel (128) peripherally associated with the first wheel (123) and rotating in the opposite direction, the second wheel (128) being designed to receive the filter bags (1) one after the other from the first

wheel (123) and to transport them along a corresponding section (62b) of a filter bag (1) feed path.

38. The machine according to claim 37, wherein the second gripper wheel (128) is designed to grip the filter bags (1) by a part of each filter bag (1) top end (15) that protrudes from the grippers (106) of the first wheel (123).

39. The machine according to claim 37 or 38, wherein the envelope forming unit (60) comprises a station (125) for feeding heat-sealable paper, in which a web (126) of material for envelopes (51) is folded onto itself about a longitudinal fold line (67) so as to define two flaps 5 (127) placed side by side and open along the top edge towards the second gripper wheel (128), the filter bags (1) being placed between the folded flaps (127) at predetermined regular intervals.

40. The machine according to claim 39, wherein the second wheel (128) places the filter bags (1) between the flaps (127) of the web 5 (126) of envelope material when the filter bags (1) and the web (126) of envelope material are moving along substantially coincident feed paths (62c, 174).

41. The machine according to claim 40, wherein the envelope forming unit (60) includes a heat-sealing station (129) where the web (126) of envelope material passing through with the filter bags (1) placed between its flaps (127) is sealed in such a way as to form a continuous 5 flattened tube (130) divided into a succession of separate chambers, each accommodating a filter bag (1).

42. The machine according to claim 41, wherein the envelope forming unit (60) comprises a cutting unit (131) designed to cut the flattened tube (130) into successive lengths corresponding to the envelopes (51).